OPERATING INSTRUCTIONS

for

TYPE 1021-A

STANDARD-SIGNAL GENERATOR

GENERAL RADIO COMPANY

CAMBRIDGE 39 MASSACHUSETTS

NEW YORK CHICAGO LOS ANGELES

U. S. A.

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October 1951

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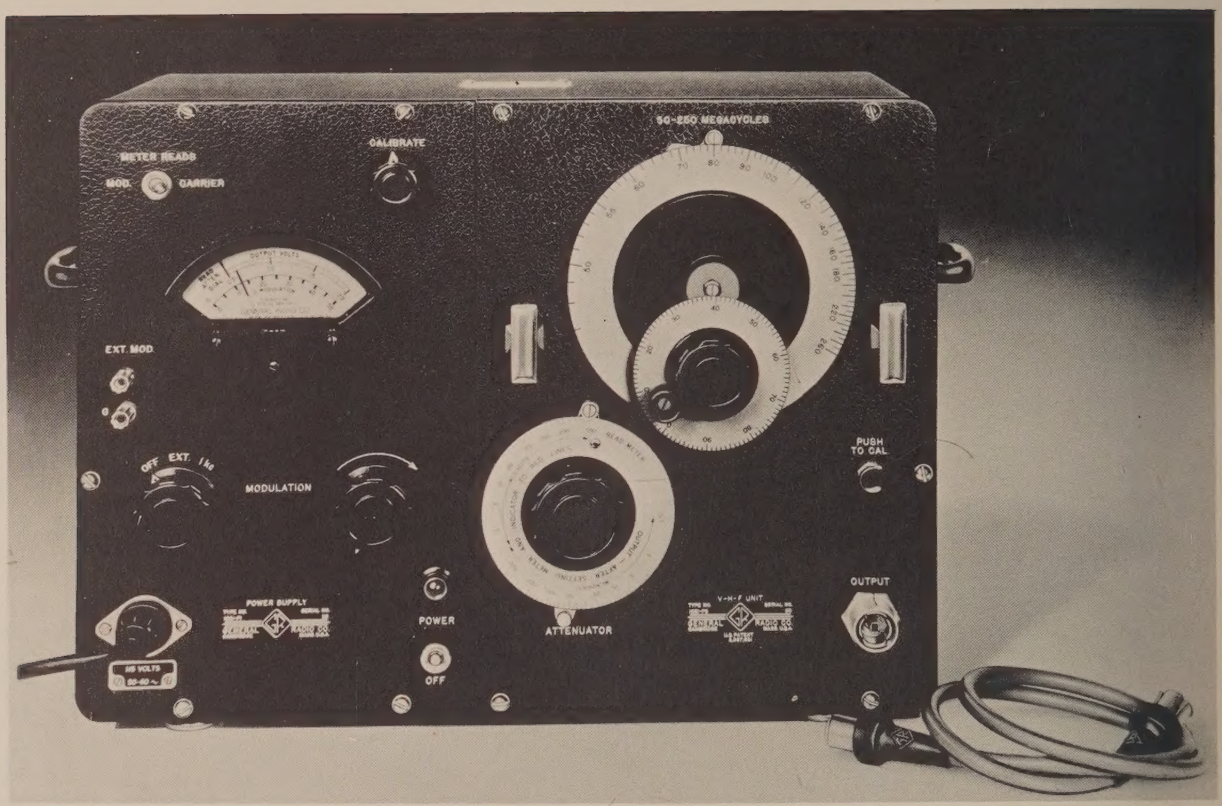

SPECIFICATIONS

Type 1021-AU U-H-F Standard-Signal Generator

Carrier Frequency Range: 250 Mc to 920 Mc in one band.

Frequency Calibration: Direct reading to ±1%.

Output Voltage: Continuously adjustable from 0.5 μv to 1.0 volt, open-circuit.

Output Impedance: 50 ohms ±10%.

Output Voltage Accuracy: Over-all accuracy of output voltage is better than ±20%. The accuracy of output voltmeter calibration between 0.5 volt and 1.0 volt is better than ±10%. The accuracy of the attenuator dial calibration for voltages between 1.0 μv and 0.1 volt is better than ±5%; from 0.1 volt to 0.5 volt, better than ±10%. At 920 Mc, the resonance error in the voltmeter is +6%.

Amplitude Modulation: Adjustable, 0 to 50%. Internal, 1000 c ±5%. External, flat within 3 db from 30 c to 15 kc. For 50% modulation, external audio oscillator must supply 18 volts across a 100 kilohm load.

Envelope Distortion: Less than 5% at 50% modulation.

Noise Level: Carrier noise level corresponds to about 0.2% modulation.

Incidental Frequency Modulation: For 50% amplitude modulation the incidental fm is approximately 100 parts per million for frequencies up to 400 Mc and is approximately 1000 parts per million at 920 Mc. When lower values of incidental fm are required, the TYPE 1000-P6 Crystal Modulator is recommended.

Leakage: Stray fields and residual output voltage cannot be detected with a receiver having 2 to 3 μv sensitivity.

Terminals: TYPE 874 Coaxial Terminals are provided for the output connection.

Power Supply: 115 or 230 volts, 50 to 60 cycles. Power input is approximately 50 watts.

Tubes: Supplied with the instrument:

1—G. R. Co. TYPE TUE-1 (modified 5861)	
1—6X5-GT	1—Amperite 6-4
1—6K6-GT	2—0C3

Accessories Supplied:

1 TYPE 874-R20 3-foot Coaxial Cable (50 Ω)
1 TYPE 874-C Coaxial Cable Connector
1 TYPE CAP-35 Power Cord

Other Accessories Available: Not supplied, but available on order are TYPE 874-GF 20 db Attenuator Pad, TYPE 874-GG 10 db Attenuator Pad, TYPE 874-K Coupling Capacitor, and TYPE 1000-P6 Crystal Modulator.

Mounting: The aluminum cabinet has a black wrinkle finish. The left-hand side houses the TYPE 1021-P1 Power Supply; the right-hand side houses the TYPE 1021-P2 U-H-F Unit. Panels are black crackle-finished aluminum.

Dimensions: (Height) 14⅜ x (width) 20¼ x (depth) 10⁹⁄₁₆ inches, over-all.

Net Weight: 37½ pounds.

Type 1021-AV V-H-F Standard-Signal Generator

Same as TYPE 1021-AU (above) except as noted.

Carrier Frequency Range: 50 Mc to 250 Mc in one band.

Incidental Frequency Modulation: For 50% amplitude modulation the incidental fm is approximately 100 parts per million for frequencies up to 100 Mc, and is approximately 500 parts per million at 250 Mc. When lower values of incidental fm are required, the TYPE 1000-P6 Crystal Modulator or the TYPE 1023-A Amplitude Modulator is recommended.

Tubes: Supplied with the instrument:

1 GE 12AT7 (Oscillator instead of TUE-1).
Other tubes as listed above.

Mounting: Cabinet is same as for TYPE 1021-AU, above. Generator consists of the TYPE 1021-P1 Power Supply and TYPE 1021-P3 V-H-F Unit.

U. S. Patent Nos. 2,125,816, 2,548,457, 2,367,681.

OPERATING INSTRUCTIONS

for

Type 1021-A Standard-Signal Generator

SECTION 1.0 GENERAL

1.1 THE TWO UNITS OF THE TYPE 1021-A

The Type 1021-A Standard-Signal Generator has a carrier frequency range of 50 - 920 Mc. Since this wide range cannot be covered in a single band and since range switching is not practical at these high frequencies the Type 1021-A Standard-Signal Generator is made in two units, the Type 1021-AV for 50 - 250 Mc and the Type 1021-AU for 250 - 920 Mc.

These two signal generators consist each of a cabinet containing the Type 1021-P1 Power Supply at the left and one of the two interchangeable r-f sections, the Type 1021-P3 for 50 - 250 Mc or the Type 1021-P2 for 250 - 920 Mc, on the right.

Functionally and in arrangement of the front panel, the two r-f sections are much alike and the following discussion applies to both unless a distinction is specifically mentioned.

If only one cabinet and power supply is available with the two r-f sections, a change can be made readily by replacing one section by the other. The only connection between power supply and r-f section is made by a multiconductor cable and plug attached permanently to the power supply.

1.2 PRINCIPLE OF OPERATION

The block diagram of Figure 1 shows the functional arrangement of the standard-signal generator. The upper part of the diagram represents either one of the two r-f sections and the lower part the power supply.

The operating frequency is set by the main six-inch dial of the carrier oscillator.

The output voltage is controlled by the ATTENUATOR. High output voltages are read directly on the CARRIER meter in the power supply which is energized

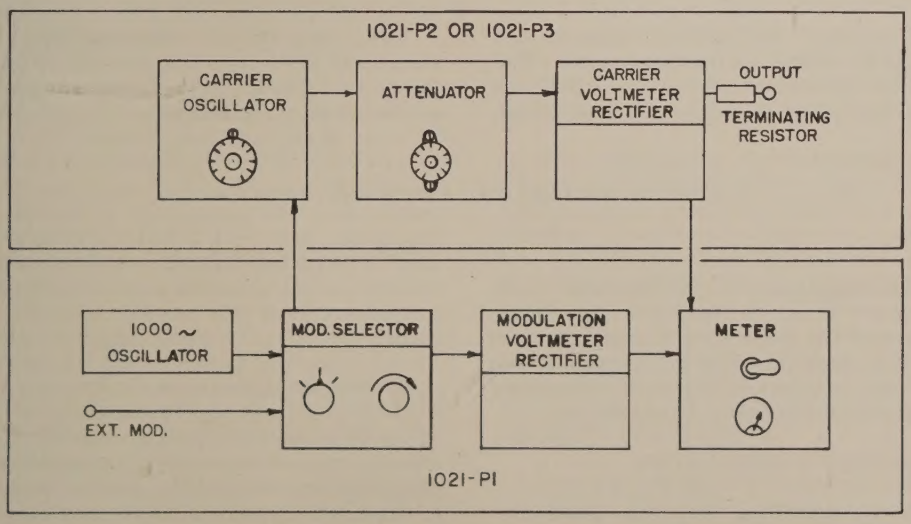

Figure 1. Functional block diagram of the Type 1021-A.

by the carrier voltmeter-rectifier contained in the r-f section. Low output voltages are set by the ATTENUATOR after establishing a reference level at 0.5 volt by means of the CARRIER meter.

The output impedance is determined by the cylindrical 50-ohm resistor between carrier voltmeter-rectifier and the output terminal on the front panel.

Amplitude modulation is produced in the plate supply of the carrier oscillator by an internal 1000-cycle oscillator or modulation amplifier depending on the position of the MODULATION switch. The depth of modulation is indicated by the panel voltmeter when the METER READS switch is set to MOD.

1.3 OPERATING CONTROLS AND CHARACTERISTICS

Figure 2 is a panel view of the Type 1021-AV Standard-Signal Generator, showing the location of the controls and fittings which are indicated schematically in Figure 1.

1.31 Frequency Dial: The 50 - 250 Mc and the 250 - 920 Mc ranges of the two signal generators are each covered in a single band at the fundamental frequency of the vacuum-tube oscillator. The frequency can be set within ±1% on a six-inch diameter direct-reading dial. The drive knob carries a 100-division dial and makes about 11 turns to cover the range.

1.32 Attenuator Dial: The ATTENUATOR dial drives the mutual-inductance-type attenuator through a rack and pinion. The dial is calibrated from 0.5 microvolt to 0.5 volt and is set to an adjustable index. The index is moved by a small knob directly beneath the attenuator dial and is set when the reference level is established.

1.33 Output Terminal: The OUTPUT terminal is a Type 874 Coaxial Connector on the front panel. The output impedance is 50 ohms. A Type 874-R20 Patch Cord with three-foot length of double shielded 50-ohm polyethylene cable and a Type 874-C Cable Connector are furnished.

1.34 Panel Meter and Meter Switch: The panel meter is located in the power supply unit and is controlled by a METER READS switch located just above and to the left of the meter. With the switch in CARRIER position, the panel meter indicates the voltage across a crystal rectifier located just ahead of the output terminating resistor. Voltages of 0.5 volt and over are read directly.

With the switch in MODulation position, the meter indicates the audio-frequency voltage appearing at the carrier oscillator plate in terms of percentage modulation. Full scale corresponds to approximately 50 volts and to 50% modulation.

1.35 Calibration Switch and Calibration Control: The calibration switch marked PUSH TO CAL. at the right-hand side of the carrier oscillator panel is a push-button switch which applies 0.5 volt 60 cycles, derived from the regulated heater supply, across the carrier voltmeter-rectifier and simultaneously turns off the plate supply of the carrier oscillator. The CALIBRATE control knob located to the right and above the panel meter adjusts the meter sensitivity so that it will read 0.5 volt when the PUSH TO CAL. button is depressed.

1.36 Modulation Controls and Terminals: Two knobs on the power supply panel are labelled MODULATION. The left-hand knob controls a switch which turns the modulation off, or selects external modulation, or internal modulation at 1000 cycles. The right-hand knob controls the amplitude of the modulating voltage appearing at the carrier oscillator plate.

When the MODULATION switch is at EXT., connections from the external modulating source are made at the terminals marked EXT. MOD. located at the left of the panel meter.

1.37 Power On-Off Switch and Pilot Lamps: Power switch and pilot lamp are mounted on the front panel. The power fuses are located inside the power supply unit on the power transformer.

SECTION 2.0 CIRCUIT AND CONSTRUCTION

2.1 CIRCUIT

The circuit diagrams of the r-f portions of the signal generator are shown in Figures 3 and 5, while the circuit diagram of the power supply, modulator, and metering portion is shown in Figure 7. Vacuum-tube layout of power unit is shown in Figure 9. Simplified diagrams are shown in Figures 4, 6, and 8.

2.2 RADIO-FREQUENCY OSCILLATOR

2.21 250 - 920 Mc Unit (Type 1021-P2): The radio-frequency oscillator for 250 - 920 Mc whose circuit is shown in Figures 5 and 6 is housed within two concentric shield cans on a cylindrically shaped aluminum casting. The tuning unit is a 2-1/2 inch diameter "butterfly circuit" in which both inductance and capacitance are varied without the use of sliding contacts. The wide frequency range is covered with approximately 80° rotation of the rotor.

The oscillator tube, V-200, is a General Radio Type TUE-1 Co-planar Triode manufactured by Philips (Type 5861) which has been modified to fit this particular circuit. Connections to its electrodes are made with flexible clamps designed to provide low-impedance paths to the tuned circuit and to conduct heat from the tube terminals to the mass of the tuned circuit for cooling. The oscillator uses a Colpitts circuit in which oscillation conditions are determined mainly by the tube grid-to-

cathode and plate-to-cathode capacitances. Additional plate-to-cathode capacitance is added by means of two small soft-copper tabs, C 207-A and C 207-B, Figure 5, held close to the plate and connected to the cathode by means of a horse-shoe-shaped supporting member.

All the tube elements are fed through chokes. Amplitude modulation up to 50% is obtained by plate voltage modulation. Both heater and plate supplies are regulated. For 50% amplitude modulation the incidental fm is less than 0.01% up to 400 Mc and less than 0.10% up to 920 Mc.

A simple but rugged and smooth 50-to-1 worm-gear drive connects the butterfly rotor to the vernier frequency control, while a pinion on the worm shaft drives the direct-reading main frequency dial by means of its internally cut spur gear. Eleven turns of the vernier dial rotate the rotor through 81° and the main dial through 270°.

2.22 50 - 250 Mc Unit (Type 1021-P3): The circuit for the 50 - 250 Mc radio-frequency oscillator is shown in Figures 3 and 4. For this lower frequency range, a 4-1/2-inch diameter "semi-butterfly" tuning unit was chosen since it can be made smaller than a true butterfly circuit. A standard miniature-type twin-triode, the Type 12AT7, is used as the oscillator tube (V-100). The two triodes are connected in push-pull across the high impedance points of the tuned circuit. The rotor turns through 180° to change the frequency from just below 50 Mc to approximately 280 Mc. Uniform output is obtained up to 250 Mc.

The oscillator is mounted on the top of the cylindrically-shaped aluminum casting and is enclosed by two concentric shield cans. All leads to the oscillator circuit are well filtered. Amplitude modulation up to 50% is obtained by plate modulation. Both heater and plate supplies are regulated. For 50% amplitude modulation the incidental fm is less than 0.01% up to 100 Mc and approximately 0.05% at 250 Mc.

A simple but rugged and smooth 22-to-1 worm-gear drive connects the butterfly rotor to the vernier frequency control, while a pinion on the worm shaft drives the direct-reading main frequency dial by means of its internally cut spur gear. Eleven turns of the vernier dial rotate the rotor through 180° and the main dial through 264°.

2.3 ATTENUATOR

The pickup or output coupling loop on the piston of the mutual-inductance-type attenuator is coupled directly to the radio-frequency field of the butterfly oscillator as shown in Figure 4 or Figure 6. The attenuator tube is located just below the oscillator tuned circuit and extends through the casting base to the rear compartment which houses the frequency and attenuator drive mechanisms. A simple electrostatic shield (or mode suppressor) is mounted at the input end of the attenuator tube, so that, except for a short distance near the input end, the radio-frequency energy is attenuated at the rate of 32 db per tube diameter. The attenuator tube has an inside diameter of .600 inch in the 250 - 920 Mc unit and .880 inch in the 50 - 250 Mc unit. To attenuate 1 volt to .5 microvolt (126 db), therefore, the pickup loop must be moved 2.36 inches in the first case and 3.46 inches in the latter. The attenuator dial, which drives the attenuator piston by means of a rack and pinion, is calibrated in accordance with this law.

2.4 OUTPUT SYSTEM

One end of the attenuator pickup loop is grounded through a 50-ohm terminating resistor, and the other end is connected to a short length of 50-ohm flexible shielded lead which connects to the Type 874-VR Crystal Voltmeter Rectifier mounted at the lower right-hand corner of the panel. The voltmeter unit is built into a coaxial T-section and the r-f output voltage is measured at a point just ahead of the 50-ohm cylindrical terminating resistor in the center conductor of the output connector. The rectified output of the crystal drives the output voltmeter located on the power supply panel.

The voltage readings on the meter and attenuator dial are open-circuit voltages. Thus, the correct value of voltage appearing across a matched, 50-ohm load is obtained by dividing the meter or attenuator dial reading by two. The voltage appearing across an arbitrary load impedance of value Z_L is $E\left(\frac{Z_L}{Z_L + 50}\right)$, in which E is the reading of the meter or the attenuator dial.

2.5 POWER SUPPLY UNIT

2.51 Power Supply: Essentially constant plate and filament voltages are supplied to the carrier oscillator by the power supply shown in Figures 7 and 8. The simple VR tube (V-3, V-4) circuit regulates plate voltage over a line voltage range of 105 to 125 volts or 210 to 250 volts at 50 to 60 cycles. The Amperite current regulator (V-1) maintains the heater voltage for the carrier oscillator. A portion of the regulated heater voltage is used as a calibrating source for the carrier voltmeter.

2.52 Modulation: The modulator circuit shown in Figures 7 and 8 consists of a single Type 6K6-GT tube (V-5) which is connected either as an L-C 1000-cycle oscillator for internal modulation or as a power amplifier for use when modulating with an external source. For 50% modulation it supplies about 50 volts r-m-s to the carrier-oscillator plate. The modulating voltage is controlled by the 100-kilohm rheostat R-10 on the right-hand side of the power supply panel. For internal modulation R-10 controls the output of the audio oscillator. For external modulation the control is switched to control the input to the amplifier.

2.53 Panel Meter: The panel meter can be switched to indicate either the d-c output from the carrier voltmeter rectifier or the d-c output from the germanium diodes of the modulation voltmeter.

SECTION 3.0 OPERATION

3.1 POWER SUPPLY

The instrument is supplied complete with tubes and is ready for operation.

The line voltage and frequency are indicated on the name plate below the power input receptacle. The power-line-frequency range is 50 to 60 cycles. The voltage range is either 105 to 125 or 210 to 250 volts. If it is desired to change from a 105 - 125 volt condition to a 210 - 250 volt condition, or vice versa, change the power transformer connections as shown in Figure 7, reverse the nameplate to indicate the appropriate line voltage and replace the fuses as specified in the parts list. The fuses are mounted on the transformer terminal plate; 1 ampere fuses are required for 115 volt operation and 0.5 ampere fuses for 230 volt.

The power supply will not operate unless one of the two r-f oscillators is connected by means of the interconnecting cable.

3.2 FREQUENCY CONTROL

The only frequency control is the vernier-drive knob on the six-inch diameter main frequency dial. The frequency range of 250 to 920 Mc or 50 to 250 Mc is covered in 270° rotation of the main frequency dial and eleven turns of the vernier knob.

3.3 METER ZERO

With the power off, the meter should indicate zero. If it does not, it can be adjusted to zero by means of the screw-driver adjustment on the meter (mechanical zero adjustment). This is the only meter zeroing required since the panel meter indicates on dc from crystal rectifiers for either modulation or carrier voltage.

3.4 CARRIER VOLTMETER STANDARDIZATION

With the METER READS switch in the CARRIER position, the carrier voltmeter can be standardized at 0.5 volt by depressing the PUSH TO CAL. switch and adjusting the CALIBRATE knob until the meter reads at the red line at 0.5 volt. Depressing the PUSH TO CAL. switch removes plate voltage from the carrier oscillator and applies 0.5 volt, 60 cycles across the voltmeter rectifier. The attenuator setting does not affect this procedure but a load which generates an appreciable terminal voltage will cause the meter to deflect and hence upset the meter calibration. Such a load, which might be a heterodyne receiver with a strong local oscillator, should have its source of voltage shut off during standardization.

The 60-cycle impedance of the load has a small effect on the standardizing voltage which can be neglected ordinarily. The standardizing voltage rheostat (R-102 or R-203) has been set for a 50-ohm load, and the error for open or shorted conditions is $\pm 1\%$.

Standardization of the carrier voltmeter should be repeated from time to time to compensate for changes of the Type 1N21-B crystal detector which may be caused by ageing, by overloads, or by changes in temperature and humidity.

3.5 SETTING OF OUTPUT VOLTAGES BETWEEN 0.5 AND 2 VOLTS

After the carrier voltmeter has been standardized, output voltages between 0.5 and 2 volts can be set directly by adjusting the ATTENUATOR until the output meter reads the desired value with the load connected. A load which generates an appreciable terminal voltage should have its source of voltage shut off when the meter is read.

Changes in carrier frequency and load impedance will change the output voltage and the carrier voltmeter reading. After every change the desired meter reading has to be restored by turning the attenuator dial.

3.6 ATTENUATOR STANDARDIZATION

With the signal generator operating at the desired frequency, with the load connected and with the meter reading carrier output voltage, adjust the carrier output level by means of the ATTENUATOR knob until the meter reads 0.5 volt. Then move the adjustable attenuator index until it lines up with the red line at 0.5 volt on the attenuator dial. Meter and attenuator dial now read alike at 0.5 volt and the attenuator is standardized for the particular frequency and load. A load which generates an appreciable terminal voltage should have its source of voltage shut off when the meter is read.

3.7 SETTING OF OUTPUT VOLTAGES BELOW 0.5 VOLT

Output voltages below 0.5 volt can be set by turning the ATTENUATOR dial until the desired value appears under the attenuator index. As the output level is decreased, the reading of the output meter is gradually decreased to zero.

Changes in carrier frequency and load impedance will change the output voltage, but, at low output levels, this change cannot be observed on the output meter. After every change the attenuator has to be standardized again at 0.5 volt.

Sometimes, particularly in circuits employing tubes and rectifier crystals, the load impedance changes with the voltage applied. This change occurs at higher voltage levels and may make it impossible to standardize the attenuator at 0.5 volt as long as the voltage on the load is equally high. If this condition is suspected, the attenuator can still be standardized at 0.5 volt if addi-

tional attenuation is inserted between the signal generator output terminal and the load. The Type 874-GF 20db Attenuator is recommended for this purpose.

3.8 OUTPUT IMPEDANCE

As long as the attenuator is standardized for each frequency and load change, the effective output impedance of the Type 1021-A Standard-Signal Generator is 50 ohms. Maintaining a constant voltage level at the reference point produces an effective impedance of zero at the output voltmeter and the output impedance of the standard-signal generator is determined by the terminating resistor at the output terminal. (See Figure 1.)

3.9 MODULATION

3.91 Amplitude Modulation of the Type 1021-A: Internal amplitude modulation at 1000 cycles, external amplitude modulation (30c - 15Kc), or no modulation may be selected by the MODULATION switch. With the METER READS switch at MODulation, the modulation level is indicated on the meter and can be adjusted by means of the MODULATION control to obtain any degree of modulation up to 50%. To obtain more accurate settings of the modulation level, the PUSH TO CAL. switch should be depressed while reading the modulation meter.

Approximately 12 volts across 100 kilohms is required from the external modulating oscillator for 50% modulation.

The Type 1021-A Standard-Signal Generator is normally amplitude-modulated by superimposing modulating voltages on the plate supply of the oscillator tubes. Incidental frequency modulation inherent with this method of modulation (see specifications) is relatively small, but may still be excessive for some applications. Amplitude modulation free of incidental fm can be obtained with auxiliary equipment at the output of the signal generator.

In the two methods outlined below, the carrier signal is amplitude-modulated by means external to the signal generator; the incidental frequency modulation is practically nil because the external modulator and the internal carrier oscillator are separated by the attenuator network.

3.92 Accurate External Modulator: The Type 1023-A Amplitude Modulator[1] is a power-line operated instrument embodying a grid-modulated amplifier capable of supplying zero to 80% amplitude modulation as indicated accurately on a panel meter. The audio source is either the internal power-line frequency (50 or 60 cycles) or an external oscillator covering the range from 20 to 15,000 cycles. The instrument is designed to work out of a 50-ohm source and into a 50-ohm load. The carrier frequency range is 5 - 220 Mc. Leakage is 45 db below the signal level. Terminals are 874-type coaxial connectors.

3.93 Television Modulator: In the Type 1000-P6 Crystal Diode Modulator[2], the resistance of a Type 1N21-B crystal is varied by modulating-frequency voltages. As a consequence, the radio-frequency output of a Type 1021-A Standard-Signal Generator can be amplitude modulated with no incidental fm if the Type 1000-P6 Modulator is inserted ahead of the load. The modulating-frequency characteristic is flat from zero up to several megacycles and it is down only 2 db at 5 megacycles. A convenient source of video modulation voltages is a television receiver tuned to a local station. The Type 1000-P6 Modulator is fitted with Type 874 coaxial terminals for the input and output connections and for the modulation circuit. The modulation range is from zero to about 50%. The modulator is designed to operate from a 50-ohm source into a 50-ohm load. To avoid distortion, the radio-frequency input to the crystal modulator must be limited to 50 millivolts. The insertion loss is approximately 12 db over the radio-frequency range of 20 - 1000 Mc.

3.10 OUTPUT CONNECTION

The new Type 874 Coaxial Connectors designed especially for u-h-f work are used as the output terminals on this signal generator. A Type 874-R20 3-foot Coaxial 50-Ohm Patch Cord and a Type 874-C Cable Connector are supplied to facilitate transmission of the output signal to equipment under test.

Three Type 874 Adaptors are available for connection to systems using Type N Connectors, the older General Radio Type 774 Coaxial Terminals, and General Radio Type 274 Plugs and Jacks.

Many other Type 874 accessories are available which are useful in extending the utility of the Type 1021-A Standard-Signal Generator in measurements of voltage, power, and standing wave ratios.

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[1] D. B. Sinclair, "A Versatile Amplitude Modulator for V-H-F Standard-Signal Generators", General Radio Experimenter, November, 1949, page 5.

[2] W. F. Byers, "An Amplitude Modulator for Video Frequencies", General Radio Experimenter, March, 1950.

SECTION 4.0 MAINTENANCE

4.1 INPUT POWER

Power input for a Type 1021-A Standard-Signal Generator is about 50 watts at 115 volts on a 60-cycle line.

4.2 TUBES, PILOT LIGHT AND FUSES

Locations of vacuum tubes, pilot light and fuses are as follows:

Type 1021-P2 U-H-F Oscillator Unit 250 - 920 Mc

V-200 General Radio Type TUE-1 Oscillator
Mounted on tuned circuit on upper side of oscillator casting within two cylindrical shield cans.

RX-201 1N21-B Rectifier crystal for rf
Mounted in output voltmeter unit back of output terminal.

Type 1021-P3 V-H-F Oscillator Unit 50 - 250 Mc

V-100 G.E. 12AT7 Oscillator
Mounted on tuned circuit on upper side of oscillator casting within two cylindrical shield cans.

RX-101 1N21-B Rectifier crystal for rf
Mounted in output voltmeter unit back of output terminal.

Type 1021-P1 Power Supply

V-1 AMPERITE 6-4 Heater Regulator
V-2 6X5-GT/G Rectifier
V-3 0C3/VR-105 Regulator
V-4 0C3/VR-105 Regulator
V-5 6K6-GT/G Modulator
Mounted on power supply shelf. Location of each is indicated in Figure 9.

RX-1 1N34 rectifier crystal for modulation
RX-2 1N34 rectifier crystal for modulation
Mounted on resistor strip.

P-1 2LAP-939 Mazda #44 6 - 8 volt
Mounted on panel.

F-1 1 amp SLOW BLOW Type 3AG
F-2 1 amp SLOW BLOW Type 3AG } 115 v.

F-1 .5 amp SLOW BLOW Type 3AG
F-2 .5 amp SLOW BLOW Type 3AG } 230 v.
Mounted on power transformer terminal plate.

4.3 REPLACING R-F OSCILLATOR TUBES

If the output of the r-f oscillator is reduced after many hours of use and particularly if the maximum obtainable output is no longer sufficient to standardize the attenuator at 0.5 volt, the r-f oscillator tube then has to be replaced. After replacing the tube a number of adjustments may be required to restore the frequency calibration and to insure that the new tube, which may require slightly different grid bias, is operating properly.

4.31 Replacing Oscillator Tube in 250 - 920 Mc Unit:

(a) To Replace Tube: Remove the two concentric shield cans on top of casting. Loosen two small screws on grid and plate clamp-type terminals and remove old tube. Insert new tube and tighten plate and grid clamps to hold tube securely but not enough to deform the copper flanges of the tube grid and plate terminals. Check the heater voltage directly at the tube terminals. It should be 6.3 volts ±5%. Turn off plate voltage, for this measurement, by depressing PUSH TO CAL. switch. If not within limits, see Paragraph 4.5.

(b) Frequency Adjustment: At the top frequency setting of the oscillator, the tube grid-to-plate capacitance, which varies slightly from tube to tube, is a considerable portion of the total tuning capacitance, hence, the top frequency obtained will vary with tube changes. The trimmer capacitance, C-208, the soft-copper tab on the plate connector, is provided to allow adjustment for tube changes. If frequency measuring equipment is available, the oscillator frequency can be reset to agree with dial at a setting of 920 Mc. The inner shield can should be in place when frequency is measured.

(c) Plate Current: With a milliammeter in series with the oscillator plate supply lead, adjust R-208 (screwdriver control in bottom of lower casting well) so that plate current is 25 ma or less as oscillator is tuned through its whole range.

4.32 Replacing Tube in 50 - 250 Mc Unit:

(a) To Replace Tube: Remove the two concentric shield cans on top of casting. The tube is located between the tuned circuit and its base casting and is on the right-hand side when one faces the panel. Remove the small hold-down clamp which is fastened to the casting with two screws. The tube can now be removed from the conventional nine-pin miniature socket. A new tube is easily inserted and the hold-down clamp should be replaced. Check the heater voltage directly at the tube terminals. It should be 6.3 volts ±10%. Turn off oscillator plate voltage, for this measurement, by depressing PUSH TO CAL. button. If not within limits, see Paragraph 4.5.

(b) Frequency Adjustment: At the top frequency setting of the oscillator, the tube grid-to-plate capacitance, which varies from tube to tube, is a considerable portion of the total tuning capacitance; hence, the top frequency obtained may vary with tube changes. The trimmer capacitance C-110, the small slotted rectangular plate spanning the gap in the top stator plate, is provided to allow adjustment for tube changes. If frequency

measuring equipment is available, the oscillator frequency can be reset to agree with the dial at a setting of 250 Mc. The inner shield should be in place when frequency is measured.

(c) Plate Current: With a milliammeter in series with the plate supply lead, adjust R-108 (screw-driver control in bottom of lower casting well) so that plate current is 25 ma or less as oscillator is tuned through its whole range. Inner shield can should be in place for the adjustment.

4.4 REPLACING RECTIFIER CRYSTAL

If the carrier output meter cannot be standardized according to the procedure outlined in Paragraph 3.4, the 60-cycle calibrating voltage may not be correct (see Paragraph 4.5) or the voltmeter crystal may be damaged and may have to be replaced. To remove the crystal from the output voltmeter: disconnect, by removing the small screw, the voltmeter output lead which is located back of the panel just below the PUSH TO CAL. switch; remove, by turning counter-clockwise, the voltmeter cap on which the output terminal is located. The crystal cartridge can now be removed by loosening the small spring clamp which holds it in place. A good 1N21-B crystal will have a forward resistance of less than 1000 ohms and a back resistance of greater than 10,000 ohms when measured with a Weston Model 663 Voltohmmeter on the R x100 range or an equivalent ohmmeter which operates from a 1.5-volt battery.

4.5 REPLACING REGULATOR TUBE V-1 IN HEATER SUPPLY

If the heater voltage as specified in Paragraphs 4.31(a) or 4.32(a) is not correct, it may be in error due to a defective V-1 regulator tube (the Amperite 6-4) or due to a change in the series resistors R-102 and R-103 in the 50 - 250 Mc oscillator (R-202 and R-203 in the 250 - 920 oscillator). The resistance values should be verified before the 6-4 tube is replaced.

If the Amperite 6-4 heater regulator (V-1) or the r-f oscillator tube (V-200 or V-100) is changed, heater currents may change enough to affect the 0.5 volt voltmeter calibrating source. This can be checked by measuring the 60-cycle voltage appearing at the Type 874-VR Output Terminal, on the panel just below the PUSH TO CAL. switch, with a reliable vacuum-tube voltmeter such as the General Radio Type 1800-A, when the PUSH TO CAL. button is depressed. Any necessary adjustment may be made with screw-driver adjustment of R-203 or R-103 mounted on the resistor strip just above the PUSH TO CAL. switch.

RESISTORS

				TYPE
R-100 =	5.1 K Ohms	± 5%		REW-6C
R-101 =	5.1 K Ohms	± 5%		REW-6C
R-102 =	10 Ohms	± 5%		REW-6C
R-103 =	10 Ohms	±10%		POSW-862
R-104 =	5.1 K Ohms	± 5%	(AB) Type EB	REC-21BF
R-105 =	10 Ohms	± 5%	(AB) Type EB	REC-21BF
R-106 =	10 Ohms	± 5%	(AB) Type EB	REC-21BF
R-107 =	5.1 K Ohms	± 5%	(AB) Type EB	REC-21BF
R-108 =	1 K Ohm	±10%		POSC-11
R-109 =	150 Ohms	± 5%	(AB) Type EB	REC-21BF
R-110 =	39 Ohms	± 5%	(AB) Type EB	REC-21BF
R-111 =	50 Ohms	± 1%	(Part of RX-100)	REU-10
R-112 =	5.1 Ohms	±10%		REW-3

CONDENSERS

		TYPE
C-100 =	16 µf 150 D.C. W.V.	COE-4
C-101 =	100 µµf	COU-8-2
C-102 =	2000 µµf	COU-10
C-103 =	200 µµf	COU-8-2
C-104 =	200 µµf	COU-8-2
C-105 =	2000 µµf	COU-10-2
C-106 =	2000 µµf	COU-10-2
C-107 =	1000 µµf ±20% (El.Reactance Corp.) "HI-K"	GP.CN-1
C-108 =	5 µµf ±0.5µµf (El.ReactanceCorp.) "HI-Q"	CC-20CG050D
C-109 =	5 µµf ±0.5µµf (El.ReactanceCorp.) "HI-Q"	CC-20CG050D
C-110 =	Built in (Air) Trimmer	
C-111 =	1000 µµf (Part of LC-101)	1021-214
C-112 =	1000 µµf (Part of LC-101)	COU-25
C-113 =	300-400 µµf Built in (Part of RX-100)	

CHOKES

		TYPE
L-100 =	185 µh	ZCHA-30
L-101 =	185 µh	ZCHA-30
L-102 =	20 µh	ZCHA-29
L-103 =	20 µh	ZCHA-48
L-104 =	Atten. Loop (Part of Atten.)	
L-105 =	2 µh (Part of LC-101)	ZCHA-37
L-106 =	185 µh	ZCHA-30

MISCELLANEOUS

LC-100 =	Butterfly 44-250 Mc	Built in
LC-101 =	Filter	1021-302
PL-100 =	Plug	CDMP-1264-8
S-100 =	T.P.D.T.	SWP-3
RX-100 =	Voltmeter Rectifier	874-309
RX-101 =	Rectifier 1N21B	(Part of RX-100)

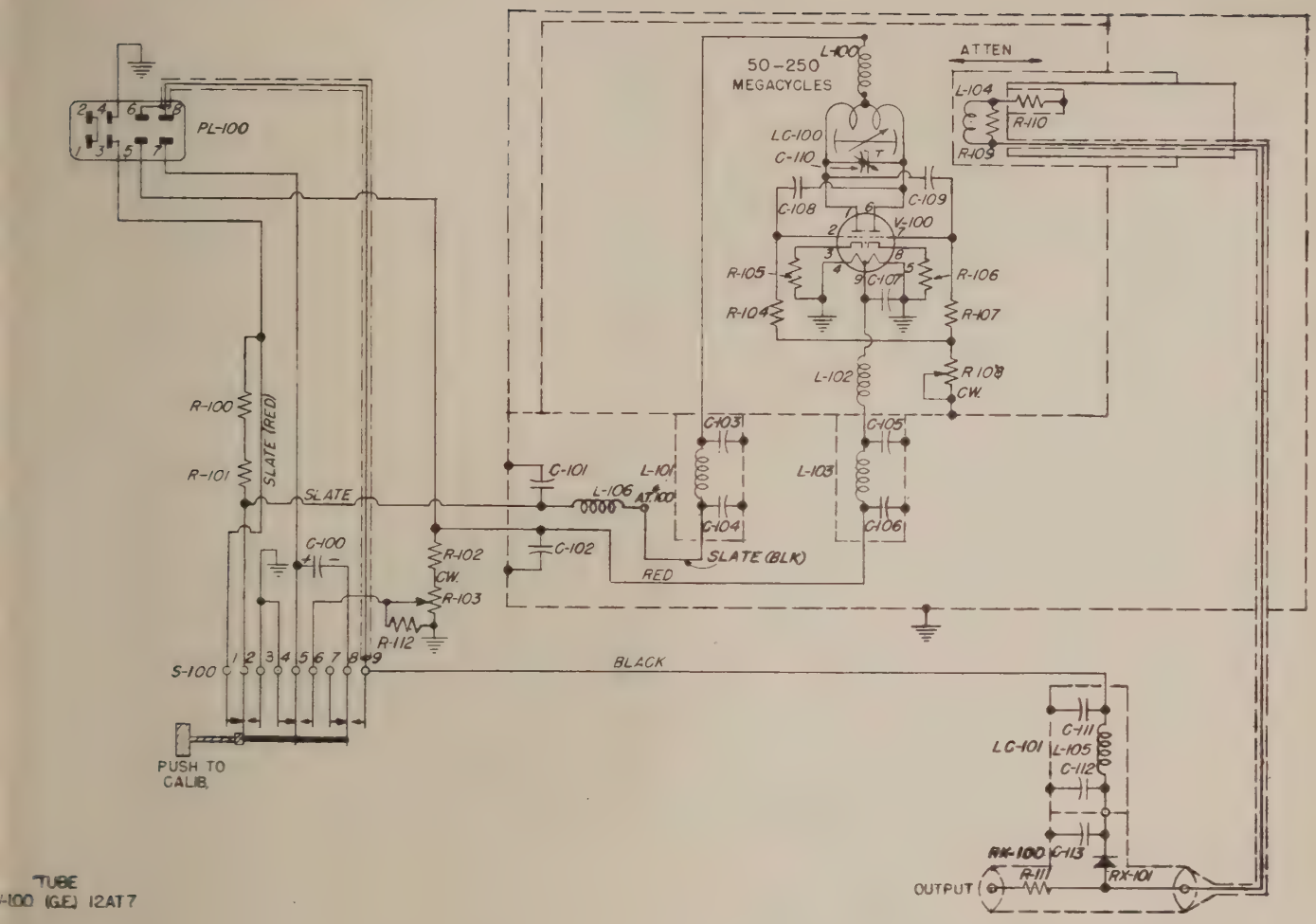

Figure 3. Wiring Diagram for Type 1021-P3 V-H-F Unit.

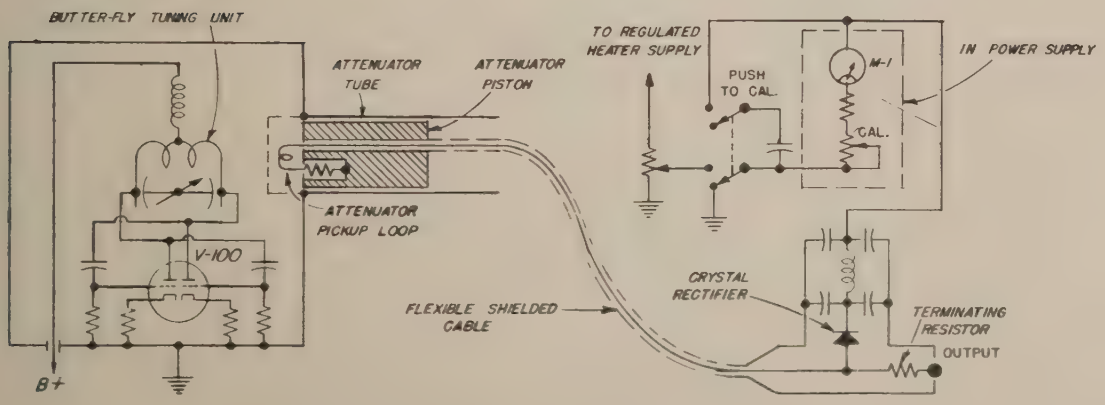

Figure 4. Schematic Diagram for Type 1021-P3.

RESISTORS			TYPE
R-200 =	5.1 K Ohms	±10%	REW-6C
R-201 =	5.1 K Ohms	±10%	REW-6C
R-202 =	24 Ohms	± 5%	REW-4C
R-203 =	10 Ohms	±10%	POSW-862
R-205 =	1.0 K Ohms	±10%	REC-21BF
R-206 =	50 Ohms	± 2%	REC-21BF
R-207 =	50 Ohms (Part of RX-200)	± 1%	REU-10
R-208 =	5 K Ohms	±10%	POSW-862
R-209 =	5.1 Ohms	±10%	REW-3

CONDENSERS		TYPE
C-200 =	16 μf 150 D.C. W.V.	COE-4
C-201 =	100 μμf	COU-8-2
C-202 =	500 μμf	COU-8-2
C-203 =	200 μμf	COU-8-2
C-204 =	200 μμf	COU-8-2
C-205 =	500 μμf	COU-8-2
C-206 =	500 μμf	COU-8-2
C-207A =	Built in (Air) Adj.	
C-207B =	Built in (Air) Adj.	
C-208 =	Built in (Air) Adj.	
C-209 =	10 μμf Built in (Mica)	
C-210 =	1000 μμf (Part of LC-201)	1021-214
C-211 =	1000 μμf (Part of LC-201)	COU-25
C-212 =	300-400μμf Built in (Mica)(Part of RX-200)	

CHOKES		TYPE
L-200 =	45 μh	ZCHA-9
L-201 =	45 μh	ZCHA-9
L-204 =	20 μh	ZCHA-48
L-205 =	45 μh	ZCHA-9
L-206 =	Atten. Loop (Part of Atten.)	
L-207 =	2 μh (Part of LC-201)	ZCHA-37
L-208 =	45 μh	ZCHA-9

MISCELLANEOUS		
LC-200 =	Butterfly 250-920 Mc	Built in
LC-201 =	Filter	1021-302
LR-1 =	Heater Filter	1021-216
PL-200 =	Plug	CDMP-1264-8
S-200 =	T.P.D.T.	SWP-3
RX-200 =	Voltmeter Rectifier	874-309
RX-201 =	Rectifier (Part of RX-200)	1N21-B

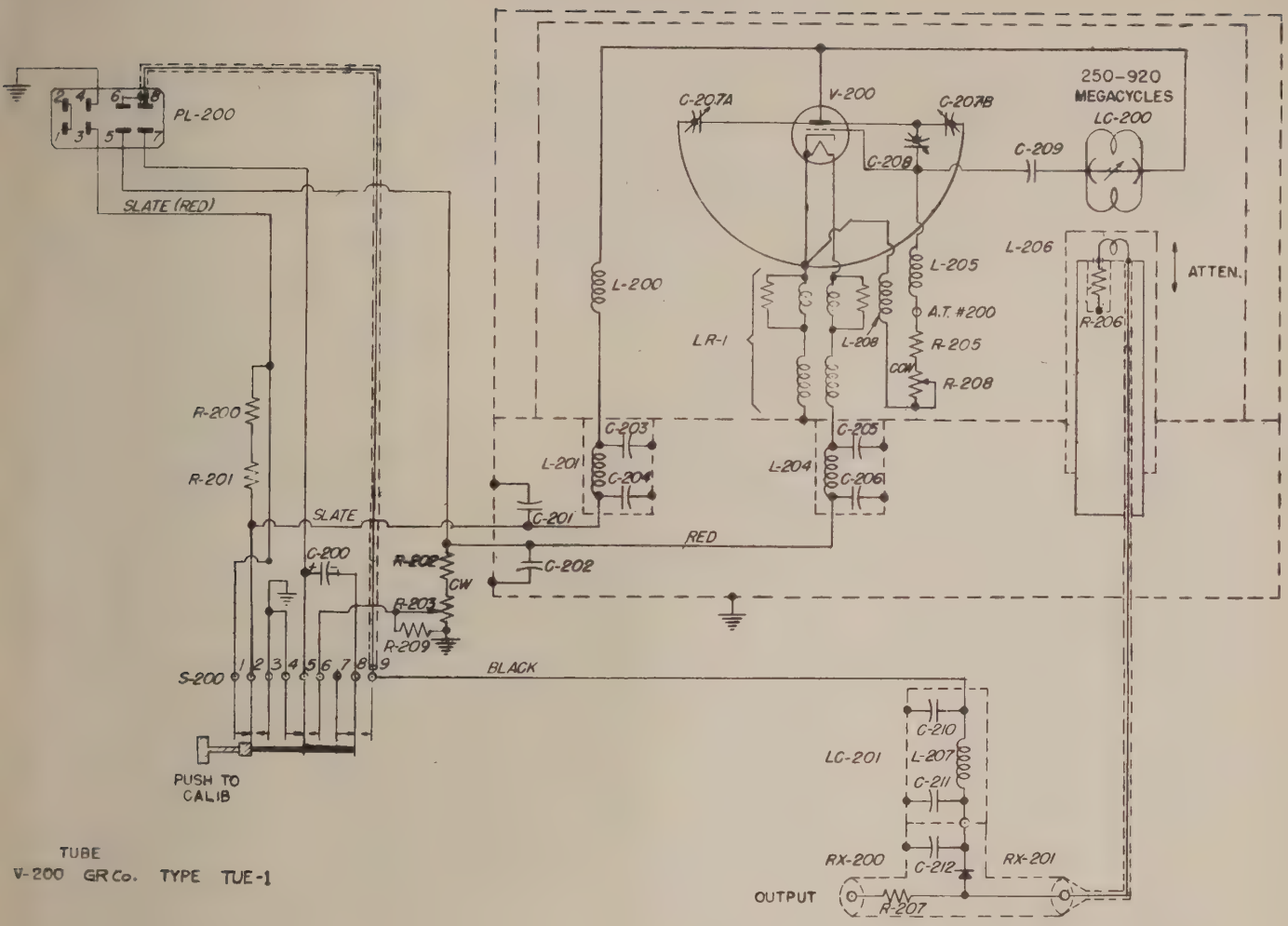

Figure 5. Wiring Diagram for Type 1021-P2 U-H-F Unit.

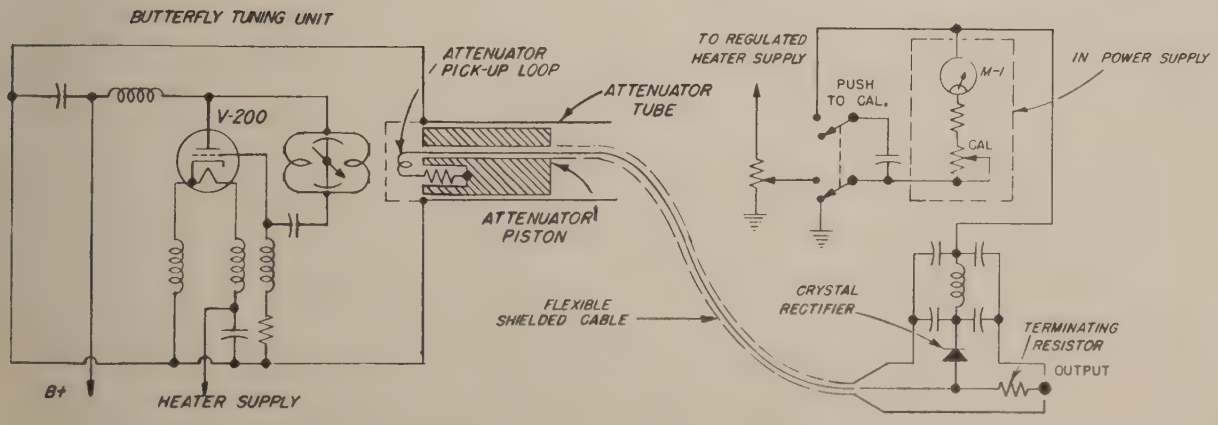

Figure 6. Schematic Diagram for Type 1021-P2.

RESISTORS

					TYPE
R1	=	33 K Ohms	± 5%	C.C.Co.	X-1/2
R2	=	33 K Ohms	± 5%	C.C.Co.	X-1/2
R3	=	3 K Ohms	±10%		POSW-862
R4	=	100 K Ohms	± 5%	C.C.Co.	X-1/2
R5	=	5.6 K Ohms	± 5%	C.C.Co.	X-1/2
R6	=	10 K Ohms	± 5%		301-A
R7	=	900 Ohms	±10%		REPO-33
R8	=	900 Ohms	±10%		
R9	=	100 Ohms	±10%		REW-3C
R10	=	100 K Ohms	± 5%		314-A
R11	=	330 Ohms	± 5%		REW-3C
R12	=	270 Ohms	± 5%		REW-3C
R13	=	750 Ohms	± 5%		REW-4C
R14	=	1 Megohm	±10%		REC-21BF
R16	=	15 Ohms	±10%		REW-3C
R17	=	180 Ohms	±10%		REW-3C
R18	=	180 Ohms	±10%		REW-3C

Part of P1 Socket

CONDENSERS

					TYPE
C1	=	.15 µf	±10%		COL-57
C2	=	.01 µf	±10%		COM-30B
C3	=	.01 µf	±10%		COM-30B
C4	=	20 µf	450 W.V.		COEB-25
C5	=	20 µf	450 W.V.		
C6	=	20 µf	450 W.V.		
C7	=	20 µf	450 W.V.		
C8	=	.02 µf	±10%		COL-33
C9	=	.15 µf	± 5%	**	COL-57
C10	=	.15 µf	±10%		COL-57
C11	=	.15 µf	±10%		COL-57

** Select to ± 5%

MISCELLANEOUS

T1	=	Transformer	485-459
L1	=	Choke	485-458
L2	=	Oscillator Coil	746-412
S1	=	DPDT	SWT-335
S2	=	DPST	SWT-333
S3	=	8P-3Position	SWRW-50
SO1	=	8 Blade Socket	CDMS-1-8
PL1	=	2 Blade Pwr. Plug	CDPP-562A
RX1	=	Crystal Rect.	IN34-A
RX2	=	Crystal Rect.	IN34-A
		For 115v. operation;	
F1,F2	=	1 Amp Slow Blow 3AG	GR#FUF-1
		For 230v. operation:	
F1,F2	=	0.5 Amp. Slow Blow 3AG	GR#FUF-1
P1	=	Pilot Light	2LAP-939 Mazda #44
M1	=	Meter (200 µa 600 Ω)	MEDS-40

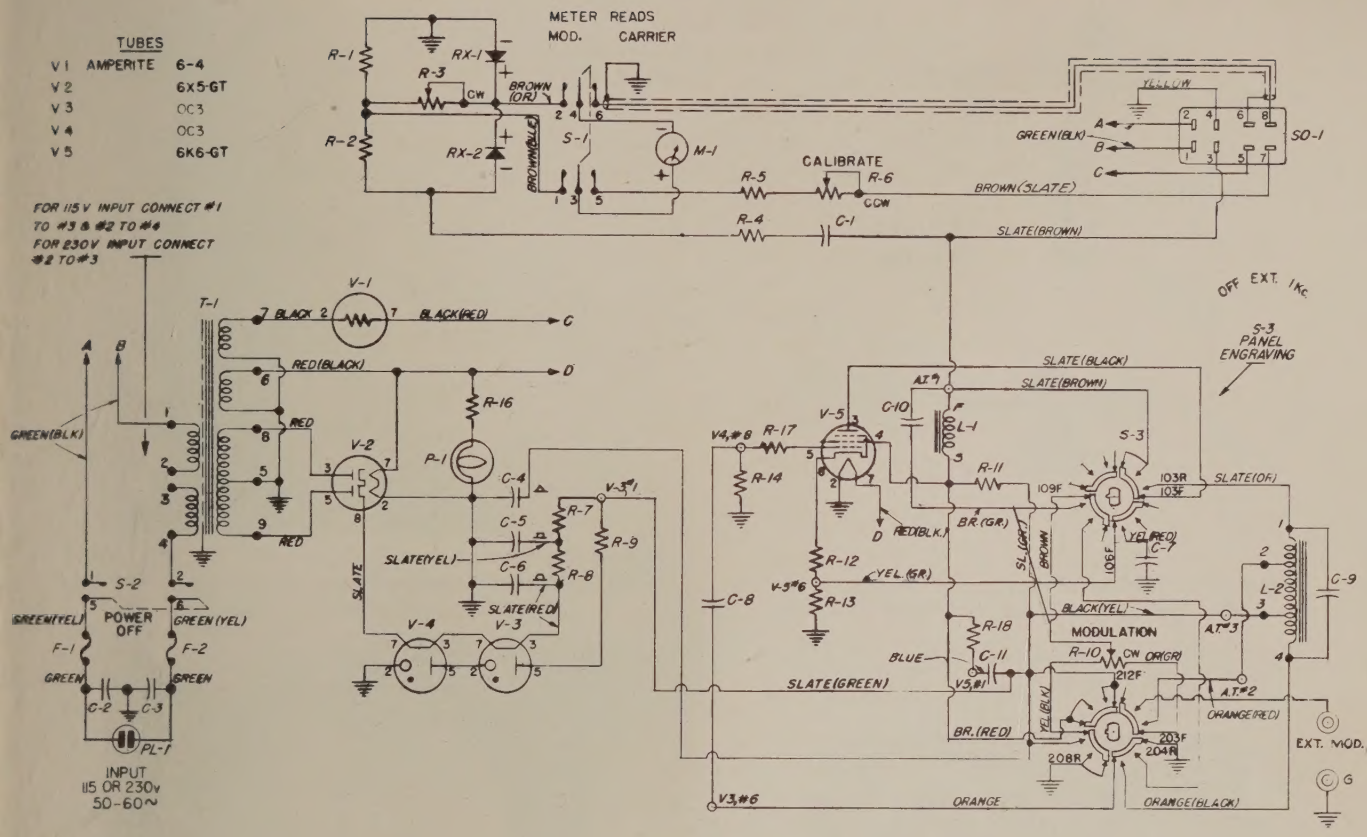

Figure 7. Wiring Diagram for Type 1021-P1 Power Supply.

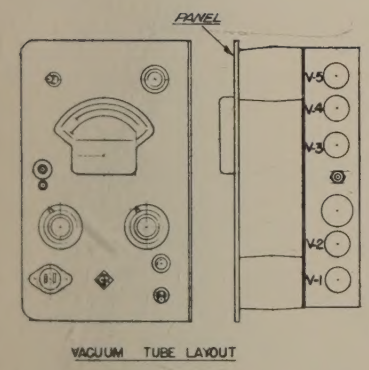

Figure 9. Vacuum Tube Layout for Type 1021-P1.

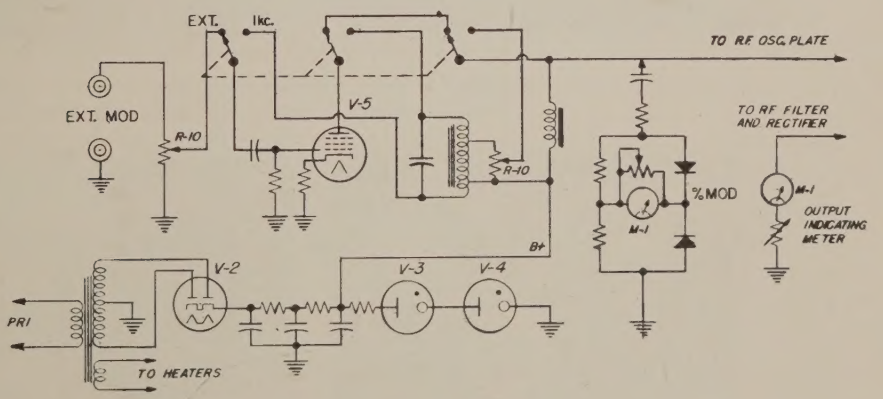

Figure 8. Schematic Diagram for Type 1021-P1.

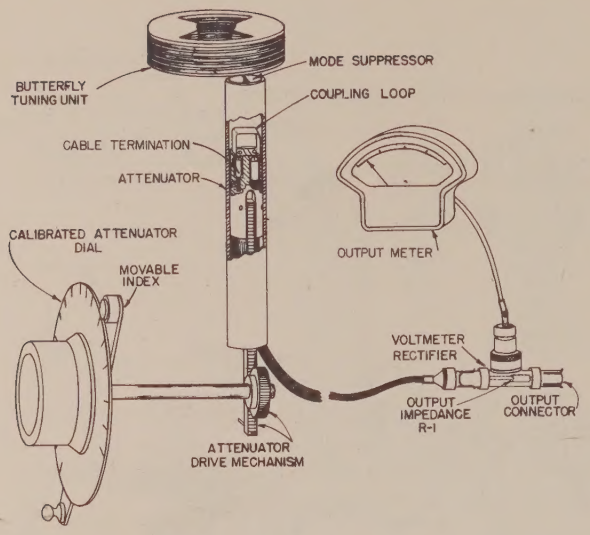

Figure 10. Functional diagram of the output system of the Type 1021-A Standard-Signal Generator.

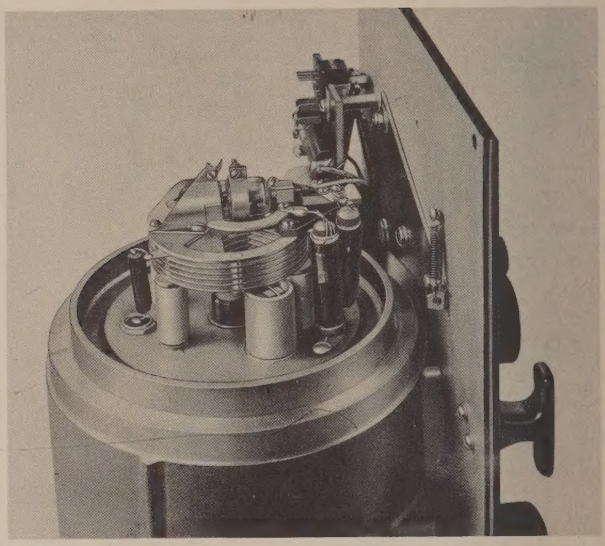

Figure 11. View of the oscillator portion of the U-H-F Unit, with cover removed from casting to show tube, butterfly, and attenuator input.

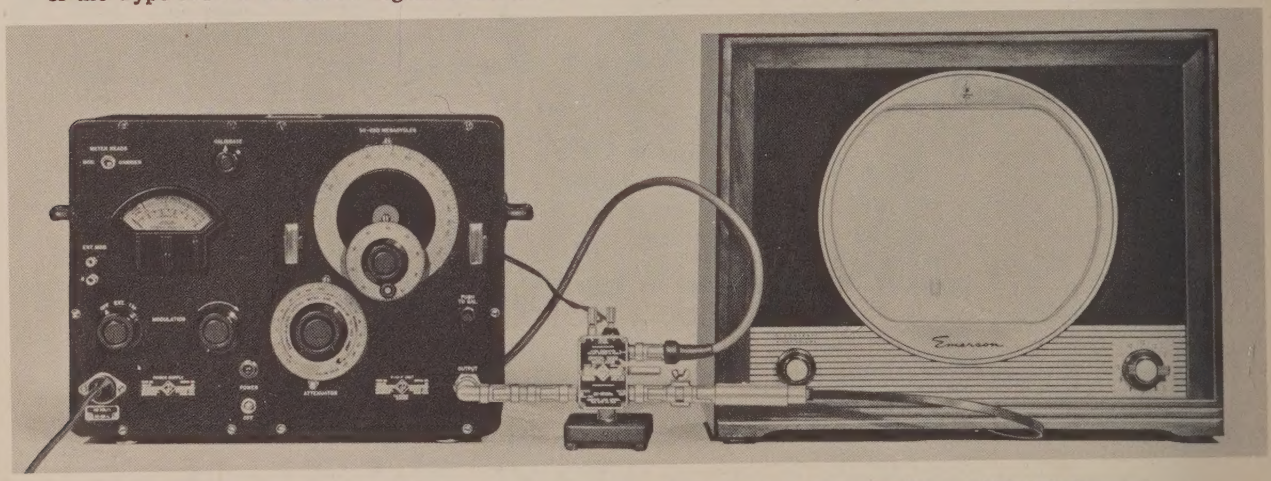

Figure 12. The Type 1021-AV V-H-F Standard-Signal Generator with the Type 1000-P6 Crystal Diode Modulator, set up for tests on a television receiver.

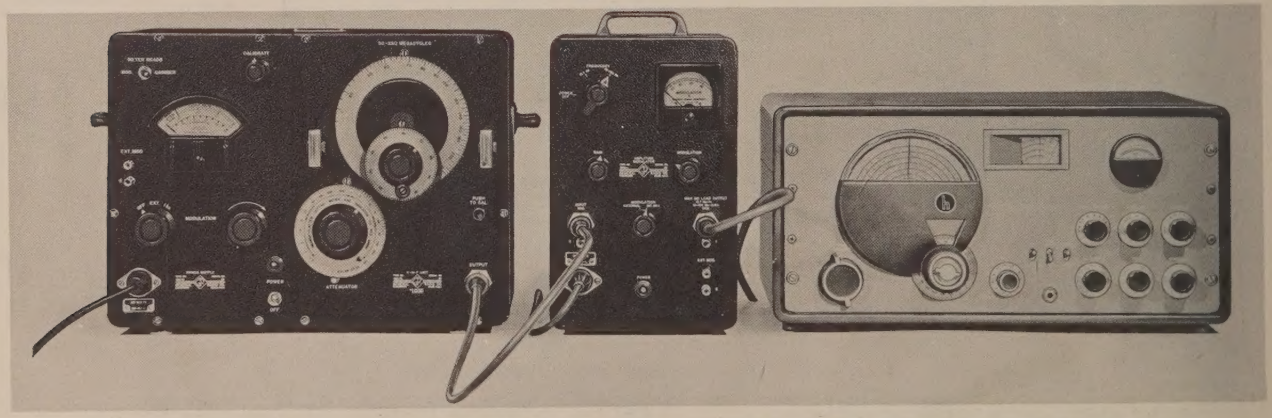

Figure 13. The Type 1021-AV V-H-F Standard-Signal Generator and the Type 1023-A Amplitude Modulator, arranged for tests on a communications-type receiver.

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